

Amdt. dated May 18, 2004
Reply to Final Office Action of Feb. 18, 2004

Serial No. 09/630,228
Docket No. TUC920000013US1
Firm No. 0018.0074

REMARKS/ARGUMENTS

Applicants canceled claims 49-51.

Applicants amended claim 47 to be in dependent form and depend from claim 43.

The Examiner found that claims 2-14, 17-29, 32-41, and 44-46 would be allowed if written in independent form to include the requirements of base and intervening claims. Applicants amended allowable claims 2, 4, 10, 17, 19, 25, 32, 34, 40, and 44 to be in independent form, including the requirements of the base claims to place these claims in condition for allowance. Further, allowable claims 3, 5, 7-9, 11-14, 18, 20, 22-24, 26-29, 33, 35, 37-39, 41, and 45 are also now in condition for allowance because they depend from one of amended independent claims 2, 4, 10, 17, 19, 25, 32, 34, 40, and 44. Further, allowable claims 6, 21, 36, and 46 are in condition for allowance because they depend from one of claims 1, 16, and 31, which are patentable over the cited art for the reasons discussed below.

The Examiner rejected claims 1, 2, 15, 16, 30, 31, 42, and 43 as anticipated (35 U.S.C. §102) by Cheong (U.S. Patent No. 5,533,189). Applicants traverse.

Independent claims 1, 16, and 31 concern updating data in a storage device, and require: receiving an update to one or more blocks of customer data at addresses in the storage device; for each block of data to update, generating metadata indicating the address of the block in the storage device and an error checking code, wherein the error checking code is generated from the customer data and compared with the customer data to determine whether the customer data in the block has changed; for each block of data to update, writing the block of data to update and the metadata for the block to cache; and for each block of data to update, transferring the block of data and the metadata for the block from the cache to the storage device.

Applicants amended claims 1, 16, and 31 to add the requirement that the error checking code is generated from the customer data and compared with the customer data. Applicants submit that this amendment should be entered because it does not add new matter that would require further searching because pending claim 6 already includes the requirement that the error checking code is generated from the customer data.

The Examiner cited col. 1, lines 15-20 and col. 5, lines 60-65 of Cheong as disclosing the claim requirement that for each block of data to update, generating metadata indicating the address of the block in the storage device and an error checking code wherein the error checking

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code is generated from the customer data and compared with the customer data to determine whether the customer data in the block has changed. (Office Action, pg. 3) Applicants traverse with respect to this amended limitation.

The cited col. 1 mentions that each cache directory entry contains an address tag and status bits, where the address tag is the tag portion of the address. The data entry and directory entry are retrieved by using the index portion of the request address. Although the cited col. 1 discusses a tag address, the tag address concerns the address of the data entry in memory, not the address of a block of data in a storage device to update as claimed.

In the Response to Arguments, the Examiner argued that the address tag is the address of the data in the lowest level of the memory hierarchy, thus indicating the address in the system memory to update. (Final Office action, pg. 6) However, the tag address of Cheong is to an address in a memory location, whether high or low level. The claims require that the address in the metadata added to the block of data being stored is the address of the block to update in the storage device, not the address of the data in cache or memory. Cheong concerns a memory management technique, where the tag address is an index to the data in the memory, not a block of a storage device to which the data is written from cache.

For instance, the claims require that the update is to one or more blocks in the storage device and that the data is written to cache, from where it is eventually transferred to the storage. Nowhere does the cited Cheong anywhere disclose generating metadata indicating the address of the block in the storage device that is written with the data to update to cache.

In the Response to Arguments, the Examiner requested clarification on the meaning of "customer data". (Final Office Action, pg. 6) Applicants submit that "customer data" refers to the user data stored in the storage device.

The Examiner cited col. 5, lines 60-65 as teaching the generating the error checking code requirement, wherein the error checking code is generated from the customer data and compared with the customer data to determine whether the customer data in the block has changed. (Final Office Action, pg. 3)

The cited col. 5 discusses a tag received from the cache directory that is inserted into a block in order to generate the tag portion of the ECC. Cheong further discusses how in memory devices, an error correction code (ECC) is generated from the memory address and the status

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information to ensure that this information is correct. (Col. 1, line 60 to col. 2, line 20)

Although Cheong discusses an ECC for a memory address to detect errors in the address of the data in memory, nowhere does the cited Cheong anywhere disclose generating an error checking code from the customer data, which is compared with the customer data to determine whether the customer data in the block has changed. Instead, the cited Cheong in cols. 1, 2, and 5 discusses generating an error checking code for the tag address and status bits, not from customer data in storage device blocks as claimed (For instance, Cheong mentions that "ECC generation pertaining to the tag and status bits can be separated and then the resulting ECC generated for each can then be summed to produce resultant ECC for the directory entry." Col. 3, lines 44-60).

Thus, the cited ECC of Cheong concerns the tag address and status bits of the directory entry in cache. The claims on the other hand require that the error checking code be used to determine whether the customer data has changed. Thus, the cited error checking code of Cheong cannot be used to perform the claim requirement of checking check whether the underlying data in the storage device has changed, because the ECC in Cheong is generated from the memory address and status bits, not the customer data as claimed.

The Examiner found that col. 1, lines 30-50 disclose the claim requirements that for each block of data to update, writing the block of data to update and the metadata for the block to cache and for each block of data to update, transferring the block of data and the metadata for the block from the cache to the storage device. (Final Office Action, pg. 3)

The cited col. 1 discusses status bits for directory entries in cache and how to retrieve entries from cache, and writing status and address tags values to a directory entry in cache. Nowhere does the cited col. 1 anywhere disclose the claim requirements of transferring both a block of data and the metadata for the block, which includes the address of the block in the storage device and the error checking code, to the storage device. Instead, the cited col. 1 concerns writing data to entries in cache, not transferring updated data and its metadata from cache to the storage device as claimed. Further, nowhere does the cited Cheong anywhere disclose the claim requirements of transferring the data and metadata including the address of the block in the storage device and the error checking code.

Amended claim 43 includes many of the requirements of amended claims 1, 16, and 31 in computer readable form, by claiming at least one data structure having: blocks of customer data;

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and a block of metadata for each block of customer data, wherein the metadata includes the address of the block in the storage device and an error checking code, wherein the error checking code is generated from the customer data and is used to determine whether the customer data in the block has changed while the block is in the cache, wherein block of data to update and the metadata for the block are written to cache.

Applicants submit that claim 43 is patentable over the cited Cheong because, for the reasons discussed above, Cheong does not disclose the claim requirements of a block of metadata for each block of customer data, wherein the metadata includes the address of the block in the storage device and an error checking code generated from customer data that is used to determine whether the customer data in the block has changed while the block is in the cache, wherein block of data to update and the metadata for the block are written to cache.

Accordingly, claims 1, 16, 31, and 43 are patentable over Cheong because the cited art does not disclose all the claim limitations.

Claims 15, 30, and 42 depend from claims 1, 16, and 31 and require that the error checking code is further capable of being used to determine whether the metadata in the block has changed. The Examiner cited col. 1, line 60 to col. 2, line 5 of Cheong as disclosing the additional requirements of these claims. (Final Office Action, pg. 3) Applicants traverse for the following reasons.

The cited cols. 1 and 2 of Cheong discuss that ECC is used to detect errors during transmission of data. The cited Cheong mentions that for memory addresses, the address for finding the entries and the stats information must be maintained so there is no loss of data in the memory address, because the loss of one bit within an address may result in a loss of the associated data. The ECC is used to detect errors in the memory address.

Nowhere does the cited cols. 1 and 2 anywhere disclose that the checking of the code is capable of determining whether the metadata in the block in the storage device has changed, where the metadata indicates the address of the block of data in the storage device and an error checking code generated from the customer data. Instead, the cited ECC of Cheong concerns detecting whether there is an error in the memory address, not the metadata in the block in the storage device. Moreover, the ECC of Cheong concerns detecting errors in a memory address maintained in memory, not metadata in a block in a storage device as claimed.

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Accordingly, claims 15, 30, and 42 are patentable over the cited art because they depend from claims 1, 16, and 31, which are patentable over the cited art for the reasons discussed above and because the limitations of claims 15, 30, and 42 provide additional grounds of patentability over the cited art.

The Examiner rejected claims 47-51 as obvious (35 U.S.C. §103) over Cheong in view of DeKoning (U.S Patent No. 5,761,705) Applicants traverse.

Claims 47 and 48 are patentable over the cited art because they depend from claim 43, which is patentable over the cited art for the reasons discussed above. Claims 49-51 are canceled.

Conclusion

For all the above reasons, Applicant submits that the pending claims 1-48 are patentable over the art of record. Applicants submit herewith the fee for the added claims. Nonetheless, should any additional fees be required, please charge Deposit Account No. 09-0449.

The attorney of record invites the Examiner to contact him at (310) 553-7977 if the Examiner believes such contact would advance the prosecution of the case.

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